

Continuous Treatment of Discrete Entities in High-Speed Manufacturing Systems

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Traditional simulation software for manufacturing lines uses discrete entity tracking to follow each product through the system. The difficulty with this type of simulation software is that as the production rate increases, the rate of entities entering the system increases and following individual entities becomes intractable. Therefore other methods of simulation analysis must be utilized for high-speed production lines.

Continuous-time simulation, which traditionally has been used in manufacturing to analyze continuous-flow chemical production, provides one solution for the problem. However, until recently, no commercial simulation software has been readily available that uses continuous process flow to track high-speed discrete production processes. This briefing discusses the use of a wave-front tracking software, Rockwell's *Arena Packaging*, to analyze the high-speed, high-volume production lines of a Fortune 500 bottling company.

Work began in June 2000 to determine how to better utilize the bottling company's existing production lines to produce more output and how to build more efficient future production lines. The areas of investigation included determining the amount of buffering needed between machines to prevent starving and blocking, the number of parallel machines necessary to prevent bottlenecks, and the locations of sensors to speed up machines based on accumulation buildups in the system. Reliability data was taken directly from production line PLC data feeds and processed into a format usable for the model. Sensor control logic and machine speeds were taken from PLC ladder logic and some line measurements were taken to collect the remaining data. Due to the accuracy of the input data and the continuous nature of the simulation software, the resulting base-case models were extremely similar to the actual production system. The results of these models and subsequent scenarios, as well as some of the limitations and areas of future research of high-speed modeling, will be discussed in the briefing.